

TWO NEW SPECIES OF *PAGURISTES*
(DECAPODA: ANOMURA: DIOGENIDAE) FROM
SOUTHWESTERN AUSTRALIA

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Abstract.—Two new species of *Paguristes* from southwestern Australia are diagnosed and described. A key to known Australian species of *Paguristes* is presented.

The genus *Paguristes* Dana has a world-wide distribution, occurring in waters ranging in depth from the intertidal to greater than 200 m. Very little is known of *Paguristes* species in Australian waters. The described Australian species are *P. aciculus* Grant, 1905, *P. brevirostris* Baker, 1905, *P. frontalis* (H. Milne Edwards, 1836), *P. pugil* McCulloch, 1913, *P. squamosus* McCulloch, 1913, *P. sulcatus* Baker, 1905 and *P. tuberculatus* Whitelegge, 1900. *Paguristes barbatus* (Heller, 1862) possibly occurs in Australia as noted by Alcock (1905) though this was disputed by McCulloch (1913). *Paguristes setosus* (H. Milne Edwards, 1848) has been recorded from New Guinea and New Zealand (Stimpson 1859, Alcock 1905) and hence might be expected to occur in Australia.

Recent collection by hand, snorkelling, and SCUBA of hermit crabs from littoral and shallow sublittoral waters of southwestern Australia from Esperance (33°52'S, 121°53'E) in the east to Dongara (29°15'S, 114°56'E) in the north and west yielded specimens of *Paguristes frontalis* and *P. sulcatus*, and of two undescribed species. The new species are described in this paper. A key is provided for the known species of *Paguristes* in Australia.

Western Australian Museum registration numbers are prefixed by WAM. Shield length is abbreviated as SL, carapace length as CL and Western Australia as W.A.

Paguristes longisetosus, new species
Fig. 1A-G

Material examined.—Holotype ♂, SL 7.3 mm, CL 11.8 mm, Two Mile Beach, east of Hopetoun, 33°57'S, 120°07'E, W.A.; shallow sublittoral rocky platform, in shell of *Thais orbita* (Gmelin, 1791); 28 Nov 1985, G. J. Morgan, WAM 1441-86. Paratypes 2 ♂♂, SL 7.3 mm and 5.0 mm, 1 juvenile in shell, type locality, from *Phasianella ventricosa* Swainson, 1822, *Nerita atramentosa* Reeve, 1855, and *Cominella eburnea* (Reeve, 1846) shells respectively; 28 Nov 1985, G. J. Morgan, WAM 1442-86. 2 ♂♂, SL 4.9 mm and 2.4 mm, 2 ♀♀, SL 4.3 mm (ovigerous) and 2.3 mm, 1 juvenile, Frenchmans Bay, 35°05'S, 117°56'E, near Albany, W.A.; shallow sublittoral rocks and sand, in shells of *Thalotia conica* (Gray, 1827); 19 Apr 1986, G. J. Morgan, WAM 1443-86.

Diagnosis.—Rostrum narrow and exceeding lateral projections. Ocular acicles multispinous. Antennular peduncles slightly shorter than or similar in length to ocular peduncles. Antennal flagella much shorter than carapace. Chelipeds subequal and spinose. Posterior lobes of telson with marginal spines. Long setae on chelipeds, pereopods and tailfan, but not obscuring spines. Coloration generally brown with cream or white spines and scattered red patches.

Description.—Shield (Fig. 1A) slightly

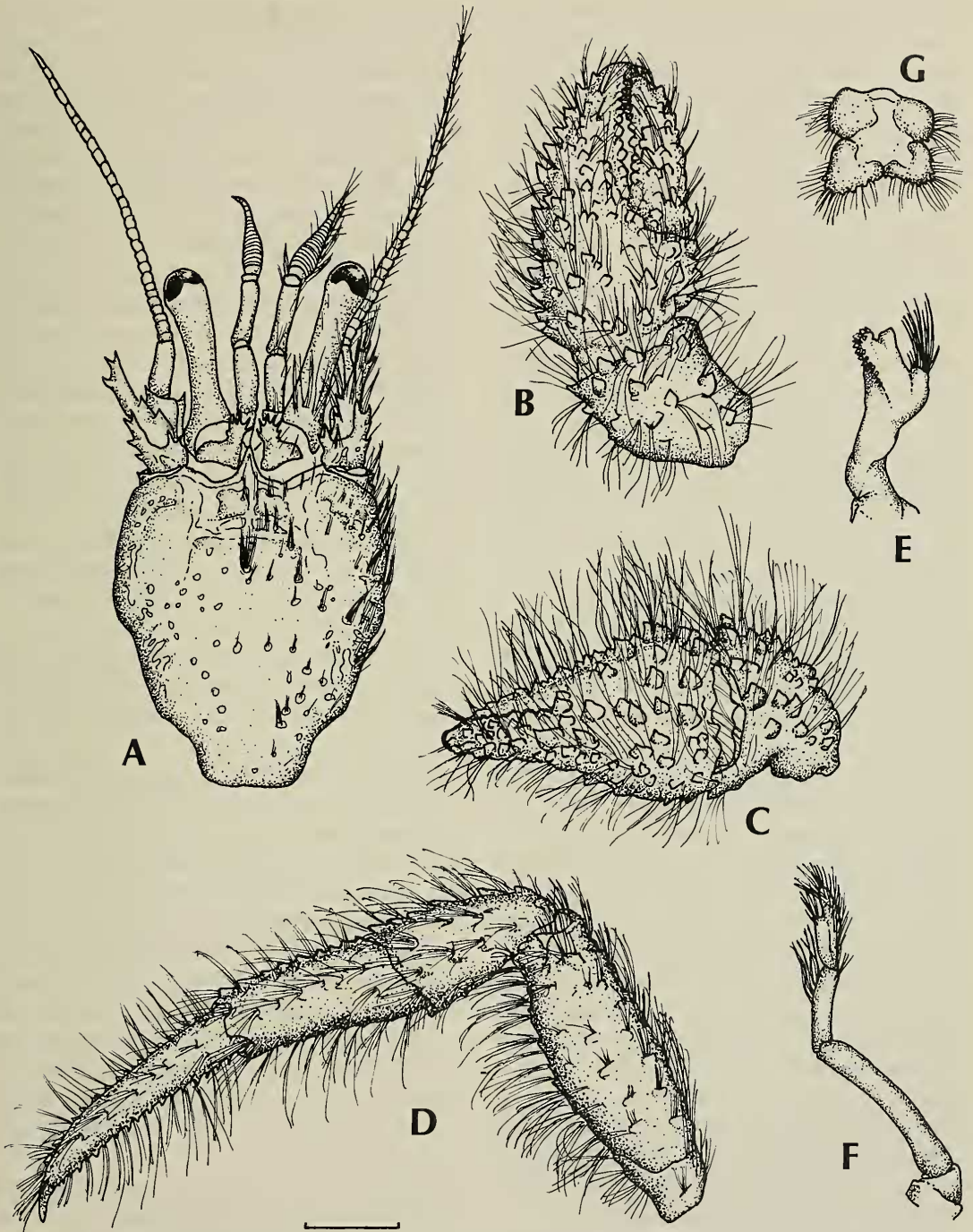


Fig. 1. *Paguristes longisetosus*, holotype ♂: A, Shield and cephalic appendages (dorsal view) (setae omitted left side); B, Left cheliped (dorsal); C, Left cheliped (lateral); D, Left second pereopod (lateral); E, Left first pleopod (lateral); F, Left second pleopod (ventral); G, Telson (dorsal). Scale = 2.0 mm (A–D, G); 1.2 mm (E, F).

longer than broad. Anterior margin between rostrum and lateral projections concave; rostrum narrow, very produced and exceeding lateral projections; lateral projections usually with small terminal spinule. Dorsal surface of shield punctate and sculptured, with coarse setae scattered dorsally, denser laterally.

Ocular peduncles long and generally cylindrical, approximately same length as width of anterior margin of shield; peduncles slightly inflated proximally and nearly naked except for long setae on proximo-dorsal surface. Ocular acicles multispinous, with 5 large and 1 small distal spines on holotype, 3–5 spines on paratypes; mesial margins slightly concave, lateral margins approximately right angular; acicles separated basally by slightly less than $\frac{1}{2}$ basal width of one acicle.

Antennular peduncles slightly shorter than or similar in length to ocular peduncles. Ultimate and penultimate segments unarmed, proximal segment with 4 distolateral and 1 distomesial spines. Peduncular setation sparse.

Antennal peduncles reaching to distal third of ocular peduncles. Fifth (ultimate) segment unarmed; fourth segment with dorsolateral spine; third with distal apical spine; second with bifid distolateral spine, 1–2 lateral spines and 1–2 spines at distomesial angle; first segment with 1–2 lateral spines. Antennal acicle reaching to or very nearly to distal end of ultimate peduncular segment; acicle terminating in bifid spine, distolateral margin with 1–2 spines, proximomesial edge with 1–3 spines. Antennal flagella much shorter than carapace. Long sparse setae on peduncular segments, longer and denser on acicle; flagellar articles each with about 10 moderately long setae.

Chelipeds (Fig. 1B, C) subequal, very spinose and hirsute; no distinct sexual dimorphism. Dactyl slightly longer than half length of propodus; cutting edge with irregularly-sized teeth, row of about 10 corneous teeth distally and large terminal corneous tooth;

dorsal and mesial surfaces with irregularly distributed spines and tubercles, larger dorsally, some corneous tipped. Dactyl slightly overlapped by fixed finger distally, small but distinct gap between fingers proximally. Fixed finger with irregularly sized cutting teeth, generally larger than those on dactyl, and large corneous terminal tooth; irregularly-sized and distributed spines and tubercles on dorsal and lateral surfaces, also on palm; spines on ventrolateral surface of propodus and ventral surface posterior to dactyl. Palm slightly broader than long. Carpus almost as broad as long, subtriangular, shorter than merus; spines on dorsal and lateral surfaces, some corneous tipped; small spine at distoventral margin. Merus compressed laterally; low tubercles on dorsomesial and lateral faces, small spines and denticles along distal, ventromesial and ventrolateral edges. Setation heavy on dactyl, propodus and carpus; setae long, mostly in clumps around base of spines but not obscuring spines, especially on dorsal surfaces; merus less hirsute, most setae along distal margin and ventral surface.

Second pereopod (Fig. 1D) slightly longer than cheliped. Dactyl longer than propodus, terminating in strong corneous claw; 18–21 and 22–25 corneous spines along ventral and dorsomesial edges respectively, ventral spines longer. Propodus with dorsal row of 8–9 spines, ventrally some small spinules at setal bases. Carpus shorter than merus, several spines on dorsal surface, tubercles at setal bases. Merus laterally compressed, unarmed except for row of spinules along ventral and dorsal margins. Tufts of long simple setae on all segments, especially on dorsal and ventral margins.

Third pereopod similar to second.

Sternite of third pereopod with anterior lobe subrectangular, gradual concavity posteriorly, abruptly concave anteriorly.

First and second pleopods of male paired, illustrated in Fig. 1E, F. Females with paired gonopores and first pleopods; brood pouch subquadrate.

Tailfan very asymmetrical, left uropods much larger than right. Telson (Fig. 1G) with left posterior lobe larger than right; left lobe with 9 spines along posterior margin, right lobe with 9–10 posterior spines also distributed along lateral margin. Anterior lobes of telson each with 1–2 lateral spinules. Telson and uropods fringed with long setae.

Coloration (in life).—Shield pale brown with setal pores cream or white and darker red/brown patches, especially along midline and midlaterally. Ocular peduncles and acicles pale brown, darker proximally; corneas black. Antennular and antennal peduncles and flagella red/brown. Chelipeds pale brown with white spines and tubercles; some red patches on carpi and meri. Pereopods red or red/brown, with white patches at setal bases forming irregular dorsal, lateral and ventral rows. Setae pale yellow or yellow/brown.

Eggs.—Ovigerous female with 15 relatively large (maximum diameter 1.2–1.3 mm) subspherical orange eggs.

Etymology.—From the Latin for “long bristles.”

Remarks.—This species is readily recognizable in southern Australia by the long setae and acute spines on the chelipeds. Unlike *Paguristes sulcatus* which also occurs along southwestern Australian shores, the setae do not obscure spination of the chelipeds. In *P. squamous* McCulloch and *P. pugil* McCulloch from southeast Australia, the palm of the chelipeds bears crenulate squamiform tubercles (McCulloch 1913).

Paguristes longisetosus is presently known only from the Hopetoun and Albany regions of Western Australia.

Paguristes purpureantennatus, new species
Figs. 2A–I, 3A

Material examined.—Holotype ♂, SL 21.2 mm, CL 33.3 mm, Cosy Corner, 35°06'S, 117°37'E, near Migo Island, Torbay, west of Albany, W.A.; 3 m, rocks and sand near *Amphibolis* and *Posidonia* seagrasses, in shell

of *Campanile symbolicum* Iredale, 1917; 1 Dec 1985, G. J. Morgan, WAM 1438-86. Paratypes ♂, SL 22.2 mm, 3 ♀♀, SL 19.0 mm (ovigerous), 15.6 mm, 15.6 mm, near Dyer Island, Rottneest Island, 32°00'S, 115°30'E, W.A.; 3–4 m, rock and sand, in *C. symbolicum* shells; 19 Dec 1985, G. J. Morgan, WAM 493-86.—2 ♀♀, SL 14.8 mm, 12.9 mm (both ovigerous), Geordie Bay, Rottneest Island, W.A.; 6 m, rock and sand, in *C. symbolicum* shells; 18 Dec 1985, G. J. Morgan, WAM 405-86.—2 ♂♂, SL 10.9 mm, 10.2 mm, offshore from Rottneest Island hotel, W.A.; 6 m, rock and sand; 19 Dec 1985, G. J. Morgan, WAM 403-86.—♀, SL 18.2 mm (ovigerous), Parker Point, Rottneest Island, W.A.; 3 m, sand, rock and *Pocillopora* coral; 19 Dec 1985, G. J. Morgan, WAM 500-86.—2 ♂♂, SL 9.5 mm and 3.8 mm, 1 juvenile, Cliff Head, 29°32'S, 114°59'E, south of Dongara, W.A.; 2–3 m, sand and rock near seagrasses; 23 Apr 1986, G. J. Morgan, WAM 1440-86.—♀, SL 4.5 mm, 4 juveniles, Seven Mile Beach, 29°11'S, 114°53'E, north of Dongara, W.A.; 1–3 m, sand and rock, in *Rhinoclavis bituberculatum* (Sowerby, 1855) shells; 22 Apr 1986, G. J. Morgan, WAM 1439-86.

Diagnosis.—Rostrum narrow, exceeding lateral projections. Ocular acicles simple, approximate distally. Antennular peduncles slightly shorter than or similar in length to ocular peduncles. Antennal flagella shorter than carapace. Chelipeds very unequal, left much larger than right; dactyls and propodi densely covered with small tubercles, dactyl of right cheliped with similarly sized tubercles. Lateral surfaces of propodi of chelipeds with distinct longitudinal ridge. Dactyls of pereopods 2 and 3 much longer than propodi. Shield red; pereopods covered with fine, short longitudinal red flecks; antennules and antennae lilac or purple.

Description.—Shield (Fig. 2A) approximately 1.5 times longer than broad. Anterior margin between rostrum and lateral projections concave; rostrum narrow, very produced and much exceeding lateral pro-

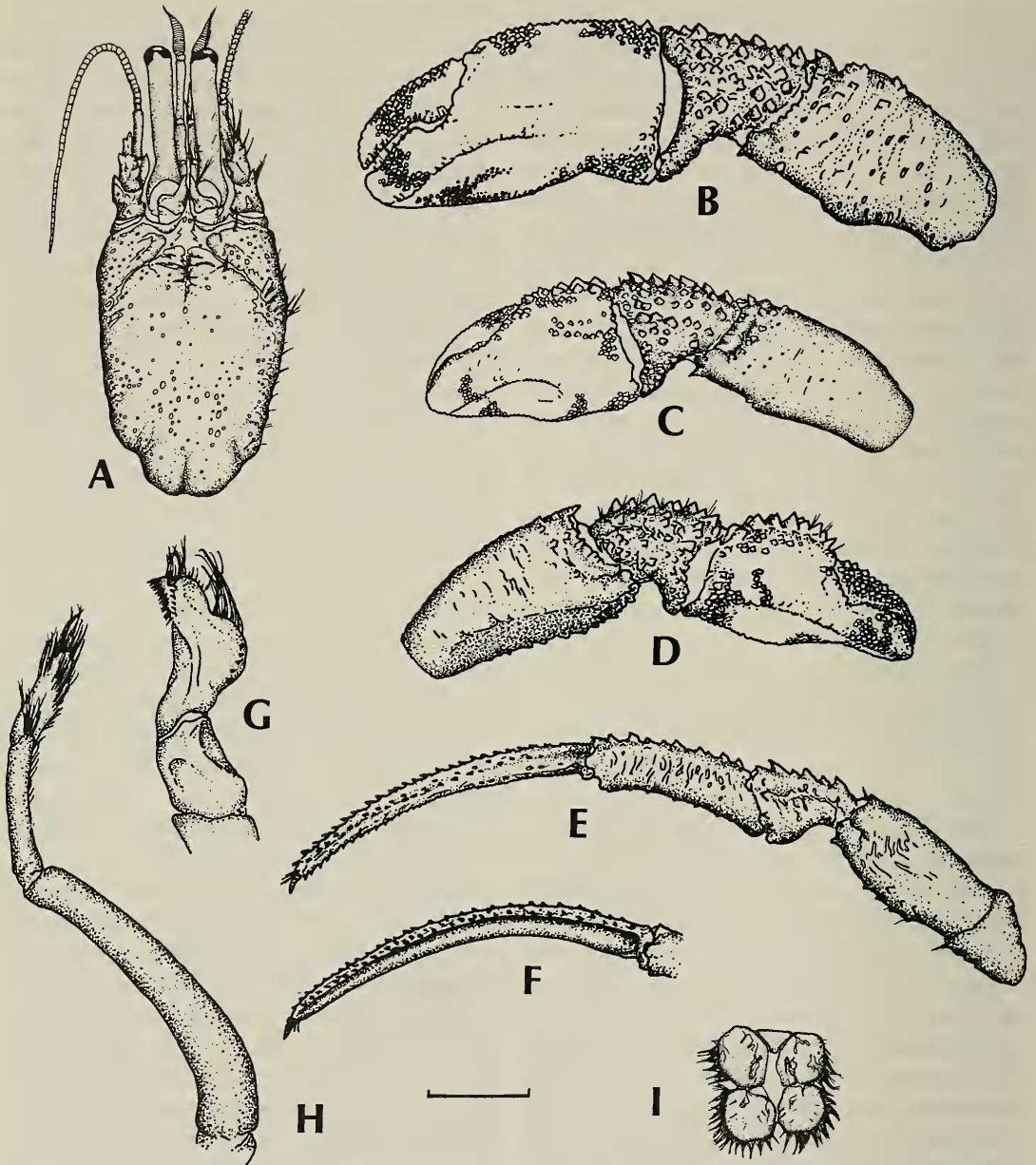


Fig. 2. *Paguristes purpureantennatus*, A, B, D-I, holotype ♂; C, paratype ♀, SL 19.0 mm: A, Shield and cephalic appendages (dorsal view) (setae omitted left side); B, Left cheliped male (lateral); C, Left cheliped female (lateral); D, Right cheliped male (lateral); E, Left second pereopod (lateral); F, Dactyl of left third pereopod (lateral); G, First pleopod male (lateral); H, Second pleopod male (ventral); I, Telson (dorsal). Scale = 10.0 mm (B, D-F); 8.0 mm (A, C, I); 2.6 mm (G, H).

jections; lateral projections with terminal spinule. Dorsal surface of shield punctate and anteriorly sculptured, with very light setation. Some spinules laterally.

Ocular peduncles long and cylindrical,

approximately same length as width of anterior margin of shield; peduncles slightly inflated proximally and almost naked. Ocular acicles simple, mesial margins convex, lateral margins almost right angular; acicles

approximate at tips, separated basally by less than half basal width of one acicle.

Antennular peduncles slightly shorter than or similar in length to ocular peduncles; peduncular segments unarmed and sparsely setose.

Antennal peduncles reaching to or slightly beyond half length of ocular peduncles. Fifth (ultimate) segment unarmed; fourth with small dorsolateral spine; third with distal apical spine; second with distolateral (often bifid) and distomesial spines; first segment unarmed. Antennal acicle reaching to proximal third or half length of ultimate peduncular segment; acicle with terminal spine, 2 distolateral spines and 1–2 proximomesial spines. Antennal flagella shorter than carapace (sometimes similar length on small specimens). Antennal setation sparse, densest on third peduncular segment and on acicle; flagella with very short setae.

Left cheliped of males (Fig. 2B) much larger than right. Dactyl half length or slightly shorter than half length of propodus; cutting edge with small, rounded cutting teeth, recessed proximally, and about 11–12 small distal corneous teeth; all surfaces of dactyl densely tuberculate. Dactyl touching fixed finger distally, narrow gap between fingers proximally. Fixed finger with small cutting teeth, protruding into proximal dactylar recess; finger with distinct broad lateral ridge curving from distal apex to lateral surface of palm, ventrolateral surface of finger and distal palm shallowly concave; sharper ventral ridge from apex of finger to distal palm, flattening on proximoventral surface of palm; blunt dorsal ridge on palm. Fixed finger and palm densely covered by small blunt tubercles, largest dorsally and very small and flattened on ventrolateral surface. Palm slightly longer than broad. Carpus longer than broad, subtriangular, much shorter than merus; carpus spinose, spines smallest laterally and mesially, larger dorsally. Merus slightly compressed laterally; dorsal and ventromesial edges with small blunt spines, elsewhere with

small scattered tubercles. Setae extremely sparse on all segments.

Left cheliped of females (Fig. 2C) smaller and less robust than that of males, but still larger than right cheliped. Propodus and dactyl densely tuberculate, larger tubercles dorsally, midlaterally and ventrally on propodus.

Right cheliped of males (Fig. 2D) more elongate than left, right propodus about $\frac{3}{4}$ length of left propodus. Dactyl approximately half length of propodus; small cutting teeth, recessed proximally, and numerous small corneous distal teeth fusing into large apical tooth; dactyl densely tuberculate, most tubercles similarly-sized though sharper dorsomesially and slightly larger proximally. Fixed finger with small cutting teeth, cutting edge produced into recess of dactyl, distal tip only slightly corneous; distinct broad lateral ridge and sharp ventral ridge on fixed finger and propodal palm, ventrolateral surface of propodus flattened. Propodus densely tuberculate, tubercles very small on ventrolateral and mesial surfaces; 1–2 irregular rows of blunt spines on dorsal ridge of palm. Carpus laterally compressed, much shorter than merus; dorsal margin with large broad-based spines, lateral and dorsomesial surfaces with spaced tubercles and small spines, ventromesial surface quite smooth. Merus with small distal spines; scattered tubercles on dorsal and lateral surfaces, small denticles along ventral edge; mesially smooth. Setation light, most setae on dorsomesial surfaces of propodus and carpus. Right cheliped of females similar to that of males, though tubercles usually slightly larger on proximodorsal surface of dactyl and lateral surface of propodus. Propodus and carpus less setose than on males.

Second pereopod (Fig. 2E) distinctly longer than left cheliped. Dactyl much longer than propodus, terminating in corneous claw; ventral row of corneous spines, largest distally, proximally very small; dense clumps of short, very thick setae in irregular rows on dorsal surface. Propodus with 8–

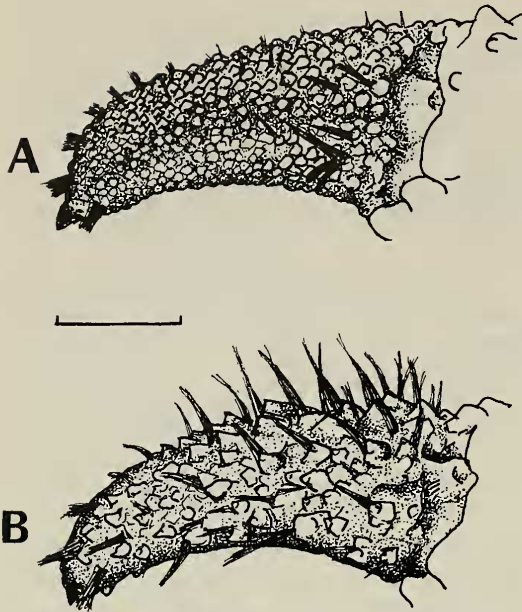


Fig. 3. Dactyl, right cheliped (mesial view): A, *Paguristes purpureantennatus*, holotype; B, *P. frontalis*, SL 24.0 mm. Scale = 4.0 mm.

11 dorsal spines, and several small scattered dorsomesial spines; small spinules ventrally. Carpus laterally compressed and with longitudinal sulcus, much shorter than merus; about 5 dorsal spines, 1–2 distolateral spines and often distolateral spinules. Merus laterally compressed, with row of small ventral spines and some dorsal spinules; 1–2 spines at distolateral angle.

Third pereopod slightly longer than second; dactyl and propodus longer, and merus shorter and less compressed, than those segments of second pereopods. Right third pereopod longer than left. Dactyl (Fig. 2F) with sharp dorsolateral longitudinal ridge; terminating in corneous spine but lacking ventral spines; clumps of short, thick setae in irregular dorsal rows. Propodal and carpal spines smaller than on second pereopod. Pereopods 2 and 3 sparsely setose; pereopods 4 and 5 with denser dorsal and ventral setation.

Sternite of third pereopod with abrupt posterior indentation and gradually concave, converging lateral sides.

First and second pleopods of male paired,

illustrated in Fig. 2G, H. Females with paired gonopores and first pleopods; brood pouch very elongate, subtriangular.

Tailfan very asymmetrical, left uropods much larger than right. Telson (Fig. 2I) with posterior lobes subquadrate, left lobe slightly larger than right; margins of both lobes unarmed, fringed with long setae.

Coloration (in life).—Shield bright red or red/brown, thorax slightly paler. Ocular peduncles orange or red, corneas black, ocular acicles orange or red. Antennular and antennal peduncles and flagella lilac or purple. Dactyls of chelipeds cream or white, sometimes tinged with pink, sometimes with pale small orange dots; propodi of chelipeds similar to dactyls, often tinged red/orange proximally; carpi and meri red/orange with white spines and tubercles. Pereopods cream or orange with numerous red or deep pink short longitudinal flecks. Very small individuals paler, pereopods cream with orange flecks.

Eggs.—Eggs subspherical, maximum diameter 1.5–1.8 mm, orange.

Etymology.—From the Latin “purpureus,” purple, and “antenna.”

Remarks.—This large species closely resembles *Paguristes frontalis* which occurs in Victoria (Phillips et al. 1984) and South Australia (Hale 1927) and ranges into Western Australia at least as far west and north as Cape Naturaliste, 180 km south of Perth. *Paguristes purpureantennatus* has been less frequently collected, though probably often confused with *P. frontalis*, and is presently known only from Western Australia from the Albany region west and north to Dongara, including Rottneest Island. The ranges of the two species therefore overlap considerably but I am not aware of their occurrence at the same locality. Microhabitat preferences of the species are not known though both inhabit broadly similar environments of shallow subtidal waters, usually in association with rocky reefs, and both frequently utilize the large *Campanile symbolicum* shells.

The two species differ in several small but

distinct morphological characters. The lateral surfaces of left and right chelipeds of *P. purpureantennatus* are more distinctly ridged than on *P. frontalis*. The dactyl of the right cheliped of *P. purpureantennatus* is ornamented dorsomesially with closely packed similarly-sized tubercles, while the dactyl of *P. frontalis* bears more widely spaced, irregularly sized spines and tubercles (Fig. 3). The dactyl, propodus and carpus of the right cheliped of male *P. purpureantennatus* are less setose than those of *P. frontalis*. Dactyls of pereopods 2 and 3 are relatively longer on *P. purpureantennatus*.

The most obvious difference between the species is their respective coloration. *Paguristes purpureantennatus* is predominantly bright red on the shield with pereopods 2–5 cream or orange and densely flecked with red or deep pink. The antennules and antennae are lilac or purple and ocular peduncles uniformly orange or red. *Paguristes frontalis* is deep salmon on the shield, with pereopods similarly colored and only sparsely dotted with deep red/brown spots at setal pores. Antennules and antennae are salmon/brown and ocular peduncles salmon with an orange band proximal to corneas. The species can be distinguished readily by coloration while alive.

There was some difficulty in deciding which of the two species was originally described as *P. frontalis*. Milne Edwards's (1836) description is insufficiently detailed to permit certain identification, but the illustration (pl. 14, fig. 1) supports the present designation in that the dactyl of the right cheliped appears to bear irregularly sized tubercles and the dactyls of pereopods 2 and 3 are not as long as those of *P. purpureantennatus*. The redescription of *P. frontalis* by Baker (1905) is more detailed though similarly inconclusive, but examination of South Australian specimens described by Baker and other material labelled *P. frontalis* in the South Australian Museum collection confirmed the present designation. The specimen illustrated in Hale (1927) as

P. frontalis would appear to bear only scattered dark spots on pereopods, again supporting the present decision.

Key to Australian Species of *Paguristes*

- 1. Chelipeds subequal 2
 - Left cheliped obviously larger than right 7
- 2. Rostrum broad, only slightly exceeding lateral projections 3
 - Rostrum acute, much exceeding lateral projections 4
- 3. Ocular acicles simple
 - *P. aciculus* Grant
 - Ocular acicles multispinous
 - *P. brevirostris* Baker
- 4. Setae on chelipeds very long, but not obscuring spines *P. longisetosus*, n. sp.
 - Setae on chelipeds moderately long, very dense and obscuring spines .. 5
- 5. Dorsal surface of propodus of chelipeds with acute spines
 - *P. sulcatus* Baker
 - Dorsal surface of propodus of chelipeds with crenulate squamiform tubercles 6
- 6. Carpus of chelipeds with antero-dorsal rounded boss
 - *P. pugil* McCulloch
 - Carpus of chelipeds lacking boss .
 - *P. squamosus* McCulloch
- 7. Rostrum short, not exceeding lateral projections; left cheliped spinose *P. tuberculatus* Whitelegge
 - Rostrum long, much exceeding lateral projections; left cheliped finely tuberculate 8
- 8. Dactyl of right cheliped with irregularly-sized tubercles and spines; pereopods salmon with scattered red spots, antennae red/orange
 - *P. frontalis* (H. Milne Edwards)
 - Dactyl of right cheliped with dense, similarly-sized tubercles; pereopods cream/orange with dense red speckling, antennae purple
 - *P. purpureantennatus*, n. sp.

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Literature Cited

- Alcock, A. 1905. Catalogue of the Indian decapod Crustacea in the collection of the Indian Museum. Part II. Anomura. Fasciculus I. Pagurides. Indian Museum, Calcutta, xi + 197 pp., 16 pls.
- Baker, W. H. 1905. Notes on South Australian decapod Crustacea. Part III.—Transactions of the Royal Society of South Australia 29:252–269.
- Hale, H. M. 1927. The crustaceans of South Australia. Part I. British Science Guild and South Australian Government, Adelaide, 201 pp., 202 figs.
- McCulloch, A. R. 1913. Studies in Australian Crustacea. No. 3.—Records of the Australian Museum 9:321–353.
- Milne Edwards, H. 1836. Observations zoologiques sur les Pagures et description d'un nouveau genre de la tribu des Paguriens.—Annales des Sciences Naturelles (ser. 2) 6:257–288, pls. 13–14.
- Phillips, D. A. B., C. P. Handrech, P. E. Bock, R. Burn, B. J. Smith, and D. A. Staples (eds.). 1984. Coastal invertebrates of Victoria. An atlas of selected species. Marine Research Group of Victoria and Museum of Victoria, Melbourne, 168 pp.
- Stimpson, W. 1859. Crustacea Anomura. I. Teleosomi.—Proceedings of the Academy of Natural Sciences of Philadelphia 1859:225–251.

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